# Chapter 7

# WATER CONSERVATION

Water conservation, also called demand management, refers to water use practices and technologies that provide the services desired by the users while using less water. The water conservation measures discussed in this section achieve long-term permanent reductions in water use. This separates them from the short-term water conservation measures and cutbacks that are required of users during water shortage situations or when short-term problems with the capacity of supply systems occur. Because of their short-term emergency nature, water shortage reductions rely almost exclusively on behavioral changes by the users (e.g., skipping or rescheduling lawn watering and taking shorter showers). Water conservation, on the other hand, generally requires changes in water use systems and technology, and little behavioral change. The water use reductions resulting from conservation will provide a basis for adjusting historical rates and patterns of water use in the modeling of the UEC Water Supply Plan.

## MANDATORY WATER CONSERVATION MEASURES

In District water use permitting rule amendments adopted in October 1992, specific water conservation requirements were imposed on public water supply utilities (and associated local governments), on commercial/industrial users, on landscape and golf course users, and on agricultural users. All of these requirements apply to users required to obtain individual water use permits. Water use (consumptive use) permitting is further discussed in Chapter 5.

### Public Water Supply Utilities

All individual permit applicants for a public water supply permit must submit a water conservation plan as a condition of issuance. The conservation plan must include the following measures: (a) adoption of an irrigation hours ordinance; (b) adoption of a Xeriscape landscape ordinance; (c) adoption of an ultra-low volume fixtures ordinance; (d) adoption of a rain sensor device ordinance; (e) adoption of a water conservation-based rate structure; (f) implementation of a leak detection and repair program; (g) implementation of a water conservation public education program; and (h) an analysis of reclaimed water feasibility.

The implementation status of these mandatory water conservation measures within public water supply utility service areas in the Martin and St. Lucie areas are

indicated in Table 20. Analysis of reclaimed water feasibility is omitted from the table. Implementation of the measures in the Okeechobee Area is not discussed due to the lack of public water supply utilities within that area.

**Table 20.** Public Water Supply Utility Conservation Implementation Status.

| Utility | Irrigation Hours Ordinance | Xeriscape Ordinance | ULV Fixtures Ordinance | Rain Sensor Ordinance | Water Conserv Rate Structure | Leak Detect & Repair Program | | Public Educ Program |
|---|---|---|---|---|---|---|---|---|
| | | | | | | % Lost | Status | |
| **Martin County** | | | | | | | | |
| Hobe Sound Water Co. | Yes | No | Yes | Yes | Yes | 13.3 | No | Yes |
| Hydratech | Yes | Yes | Yes | Yes | Yes | 4.4 | No | Yes |
| Indiantown | Yes | Yes | Yes | Yes | Yes | 3.5 | No | Yes |
| Martin County – Martin Downs | Yes | Yes | Yes | Yes | Yes | 18.4 | Yes | Yes |
| Martin County - North | Yes | Yes | Yes | Yes | Yes | 13.3 | Yes | Yes |
| Martin County – Port Salerno | Yes | Yes | Yes | Yes | Yes | 10.2 | Yes | Yes |
| Martin County - Tropical Farms | Yes | Yes | Yes | Yes | Yes | N/A | Yes | Yes |
| Stuart | Yes | Yes | Yes | No | Yes | 13.5 | Yes | Yes |
| **St. Lucie County** | | | | | | | | |
| Ft. Pierce | No | No | No | No | Yes | 10.0 | Yes | Yes |
| Holiday Pines | No | Yes | No | Yes | No | 3.9 | No | No |
| Port St. Lucie | No | Yes | Yes | Yes | No | 9.0 | No | Yes |
| Reserve | No | Yes | No | Yes | No | 9.0 | No | No |
| St. Lucie West | No | Yes | Yes | Yes | No | 5.0 | Yes | Yes |

Source: July 1997 phone interviews with local planners and utility staff.

Four of the mandatory water conservation measures require adoption of an ordinance by local government. Generally, because of the autonomy of local governments in the UEC Planning Area, each ordinance has to be adopted by each unit of local government for the measure to be fully implemented. Positive responses in the table reflect the adoption of the appropriate ordinance by the applicable local government.

**Adoption of an Irrigation Hours Ordinance.** The ordinance, at a minimum, limits all lawn and ornamental irrigation to the hours of 4:00 P.M. to 10:00 A.M. Exemptions such as hand watering with a self-canceling nozzle, low volume irrigation systems, irrigation systems whose sole source is reclaimed water or seawater, or to operations for the purpose of system repair or maintenance may be included in the

ordinance. It is assumed that most urban landscape irrigation already takes place during acceptable hours.

Irrigation during daytime hours is generally less efficient. The sunlight and increased winds during the restricted daytime hours cause some of the water to evaporate before hitting the ground or to blow onto impervious surfaces such as sidewalks, roads and driveways. The wind also causes the water that reaches the plants to be more unevenly applied. In addition to changing the time of irrigation, users will need to reduce the length and frequency of irrigation. Public education programs can contribute to the irrigation hours ordinance by informing irrigators how they can reduce applications while still meeting the water requirements of their plants. Even if applications are not reduced, more water will reach the plants and soil when the prescribed hours are followed.

**Adoption of a Xeriscape Landscape Ordinance.** Xeriscape is defined by the Florida Legislature to mean "a landscaping method that maximizes the conservation of water by the use of site-appropriate plants and an efficient watering system" (Section 373.185, F.S.). The principles of Xeriscape include planning and design, soil analysis, efficient irrigation, practical turf areas, appropriate plant selection, and mulching.

The legislation requires that the water management districts establish incentive programs and provide minimum criteria for qualifying Xeriscape codes. These codes prohibit the use of invasive exotic plant species, set maximum percentages of turf and impervious surfaces, include standards for the preservation of existing native vegetation, and require a rain sensor for automatic sprinkler systems. District rules, as mandated by the legislature, require that all local governments consider a Xeriscape ordinance and that the ordinance be adopted if the local government finds that Xeriscape would be of significant benefit as a water conservation measure relative to the cost of implementation. The Xeriscape landscape ordinance will affect new construction and landscapes undergoing renovation which require a building permit.

**Adoption of an Ultra-Low Volume Fixture Ordinance.** This measure requires adoption of an ordinance which requires the installation of ultra-low volume (ULV) plumbing fixtures in all new construction. The District's water use permit regulations specify that the fixtures have a maximum flow volume when the water pressure is 80 pounds per square inch (psi) as follows: toilets, 1.6 gal/flush; shower heads, 2.5 gal/min.; and faucets, 2.0 gal/min. The previous standard for plumbing devices was: toilets, 3.5 gal/flush; shower heads, 3.0 gal/min.; and faucets, 2.5 gal/min.

ULV fixtures save water by using less water to provide the services desired. Available data indicate that the performance of the systems is such that the savings per unit (per flush or per minute) will not be offset by having the users increase the number of units (number of double flushes or length of shower). Thus these permanent ongoing water savings can be obtained without any behavioral changes by the users.

**Adoption of a Rain Sensor Device Ordinance.** This measure requires adoption of an ordinance which requires any person purchasing or installing an automatic sprinkler system to install, operate, and maintain a rain sensor device or an automatic switch. This equipment will override the irrigation cycle of the sprinkler system when adequate rainfall has occurred.

**Adoption of a Conservation Rate Structure.** A conservation rate structure is a charging system used by utilities that provides a financial incentive for users to reduce demands. Water conservation rates are generally either (a) increasing block rates, where the marginal cost of water to the user increases in two or more steps as water use increases; or (b) seasonal pricing, where water consumed in the season of peak demand, such as from October through May, is charged a higher rate than water consumed in the off-peak season. Maddaus (1987) also lists uniform commodity rates as a conservation rate structure.

Users faced with higher rates will often achieve water conservation by implementing a number of the conservation measures discussed in this chapter. The most frequently used conservation rate structure used by utilities is increasing block rates. This rate structure generally is expected to have the largest impact on heavy irrigation users. The responsiveness of the customers to the conservation rate structure depends on the existing price structure, the water conservation incentives of the new price structure, and the customer base and their water uses.

**Adoption of a Utility Leak Detection and Repair Program.** The District encourages public water supply systems to have no more than 10 percent unaccounted-for water losses. The implementation of leak detection programs by utilities with unaccounted-for water losses greater than 10 percent is required. The leak detection program must include water auditing procedures, and in-field leak detection and repair efforts.

**Implementation of a Water Conservation Public Education Program.** Public information, as a water conservation measure, involves a series of reinforcing actions to inform citizens of opportunities to reduce water use, give reasons why they should choose to practice water conservation, and publicize the conservation options being promoted by the District, local governments and utilities. Virtually all users can be affected by public information efforts, although they are typically targeted at the uses with the broadest participation, including domestic indoor and outdoor uses.

**Analysis of Reclaimed Water Feasibility.** For potable public water supply utilities who control a wastewater treatment plant, an analysis of the economic, environmental, and technical feasibility of making reclaimed water available is required. Wastewater reuse is discussed in Chapter 8, Water Source Options.

### Commercial/Industrial Users

District regulations require that all individual commercial/industrial permit applicants submit a conservation plan. This plan must include:

a. An audit of water use,
b. Implementation of cost-effective conservation measures,
c. An employee water conservation awareness program,
d. Procedures and time frames for implementation, and
e. The feasibility of using reclaimed water.

### Landscape and Golf Course Users

Landscape and golf course permittees are required to use Xeriscape landscaping principles for new projects and modifications when they find this to be of significant benefit as a conservation measure relative to its cost. They are also required to install rain sensor devices or switches, irrigate between the hours of 4:00 P.M. and 10:00 A.M., and analyze the feasibility of using reclaimed water. There are, however, six specific exceptions to the irrigation hours limitations in the rule which provide for protection of the landscape during stress periods and help assure the proper maintenance of irrigation systems.

### Agricultural Users

Citrus and container nursery permittees are required to use micro irrigation or other systems of equivalent efficiency. This applies to new installations or upon modifications to irrigation systems. The permittees are also required to analyze the feasibility of using reclaimed water.

## SUPPLEMENTARY WATER CONSERVATION MEASURES

### Urban Users

**Indoor Audit and Retrofit.** Indoor audits provide information and services directly to households and other urban water users to achieve greater efficiency in the use of indoor water-using appliances. This option generally includes inspections to locate leaks and determine if plumbing devices are operating properly, repair of minor problems, and providing information on conservation measures and devices. In some cases, a retrofit program will include installation of water-conserving shower heads and toilet dams.

Residential retrofit measures encourage the installation of ULV plumbing fixtures or modifications which improve the performance of existing fixtures. One possible incentive is a partial financial subsidy to increase the installation of ULV water fixtures. Another incentive, recently undertaken in Tampa, is the delivery of retrofit kits to homes. The targeting and participation in efforts such as this will generally affect only a portion of the population. Utilities and local governments can devise programs that carefully target the most cost-effective applications of these measures. In retrofit programs, one option is to target residences with only high water consuming fixtures (generally those built pre-1980). Another option is to include residences with low water use fixtures (post-1980) for retrofit with ULV water use fixtures.

Another characteristic which will increase the savings and the cost effectiveness of retrofit of the earlier dwelling units (homes) is that many of these units have fewer bathrooms and fixtures per unit and per person. The larger the number of people using a retrofit device, the more cost effective and water saving the retrofit. An appropriate strategy would be to target homes with large numbers of persons per fixture for complete retrofit, and other homes for retrofit of only the most heavily used fixtures. This suggests that a particularly suitable target for retrofit programs are public restrooms and other facilities which have high use rates.

**Landscape Audit and Retrofit.** Landscape audits are measures that improve the efficiency of irrigation systems, and include services to determine if the irrigation system is operating properly. This may include adjustments to irrigation timers (to assure that a water-conserving schedule is being followed), head replacement (to assure that the system is providing adequate coverage and not wasting water by irrigating impervious surfaces), recalibration of the irrigation system, and installation of rainfall sensing/irrigation controlling devices.

Audits are generally implemented by utilities and other water management agencies. Because of the large outdoor component of water use in South Florida,

irrigation audits can be effective. This is particularly important due to the peaking of outdoor demand during periods of low rainfall and maximum stress on water resources.

Landscape retrofit measures provide information and incentives for users to implement physical changes to their landscapes and irrigation systems. Devices suitable for landscape retrofit include those that prevent unnecessary irrigation by detecting recent rainfall or sensing soil moisture. Other retrofit options include replacing existing landscaping with site-appropriate plants and practicing landscape management which includes rezoning irrigation systems and mulching.

Cost and water savings for several indoor and outdoor urban retrofit water conservation measures are provided in Tables 21 and 22. In addition, the cost and water savings for irrigation system conversion for agricultural are discussed. This information in this section should not be interpreted as a benefit-cost analysis of these conservation measures, since no discounting is applied to the streams of cost and benefits.

**Table 21.** Representative Water Use and Cost Analysis for Retrofit Indoor Water Conservation Measures.

| | Toilet | Showerhead |
|---|---|---|
| Cost/unit ($) | $200 | $20 |
| Flushes/day/person | 5 | -- |
| Gallons saved/flush | 1.9 | -- |
| Minutes/day/person | -- | 10 |
| Gallons saved/minute | -- | 2 |
| Persons/unit | 2.5 | 2.5 |
| Life (years) | 40 | 10 |
| Savings/year/unit (gallons) | 8,670 | 9,125 |
| Savings/unit over life (gallons) | 346,800 | 91,250 |
| Cost/1000 gallons saved | $0.58 | $0.22 |
| Savings/cost | 1.73 | 4.56 |

**Table 22.** Representative Water Use and Cost Analysis for Retrofit Outdoor Water Conservation Measures.

| | Rain Switch | Mobile Irrigation Lab |
|---|---|---|
| Cost/unit or visit ($) | $68 | $50* |
| Acres/unit | 0.11 | 0.11 |
| Water savings (inches/year) | 70 | 70 |
| Water savings (gallons/year) | 209,070 | 209,070 |
| Life (years) | 10 years | 7 years |
| Water savings/life (gallons) | 2,090,700 | 1,463,493 |
| Cost/1,000 gallons saved ($) | $0.033 | $0.034 |
| Savings per 1,000 gallons/cost | 30.75 | 29.27 |

*Represents additional cost of site visit (currently compensated by NRCS and the District).

For the urban water conservation methods, the analysis indicated the savings are greater than the costs. The savings per unit of cost associated with the outdoor conservation measures are generally greater than those for indoor conservation measures, primarily because of the larger volumes of water involved per unit affected by the outdoor conservation measures. Water savings associated with implementation of retrofit programs can be significant. For example, if 10,000 showerheads were retrofitted in an area, this could result in a water savings of 182 MGY (0.50 MGD). Likewise, if 10,000 irrigation systems were retrofitted with rain switches, this could result in a water savings of over 2 BGY (5.73 MGD).

### Public Water Supply Utilities

**Filter Backwash Recycling.** This measure encourages water utilities using filter systems that are cleaned by backwashing (cleaning the filter by reversing the flow of water) to recycle the backwash water to the head of the treatment plant for retreatment. Otherwise, the backwash water is usually disposed of into a pit from which the water seeps back into the ground. An August 1994 survey of utilities in the UEC Planning Area indicated that only two (Fort Pierce and Stuart) out of the six lime softening facilities recycle their filter backwash.

**Distribution System Pressure Control.** Potable water distribution system pressure control measures reduce water usage while providing acceptable water pressures to all customers. System pressure should keep water-using devices working properly while providing for public health and fire safety needs. Pressure reduction valves and interconnecting and looping utility mains, are methods used to equalize and, therefore, reduce overall operating pressure. Unlike the pressure reduction efforts

during water shortages, which call for reductions in pressures to levels necessary to meet minimums for fire flow, these changes target reductions at locations where pressures are high within the system.

Control of pressures can save water in a number of ways. High pressures increase losses of water through leaks, and increase use when the amount of water used is based on time rather than the volume of water discharged. Irrigation systems on timers are the major uses wherein the use is for set periods of time. High pressures cause increases in water application and can cause atomization of the spray, which reduces irrigation efficiency. Low pressures, however, reduce the areas covered by poorly designed sprinkler systems, and this results in stress to the uncovered areas. This may encourage users to increase irrigation time in an attempt to improve the results of the irrigation efforts.

**Wastewater Utility Infiltration Detection and Repair.** Wastewater utility infiltration detection and repair includes estimation and detection efforts to quantify and locate the infiltration of ground water or surface water into wastewater collection systems, and repair efforts to reduce the infiltration. Infiltration is important in the UEC Planning Area because many wastewater collection lines are located below the water table for much of the year. Reducing infiltration of ground water prevents waste by allowing the ground water to be used for other purposes. In coastal areas, infiltration of saline ground water minimizes the potential reuse of the wastewater by increasing the chloride level. Infiltration also uses available treatment and disposal capacity.

### Agricultural Users

**Irrigation Audit and Improved Scheduling.** Growers are encouraged to adopt irrigation management practices, which conserve water. To assist growers with agricultural irrigation, audits are carried out by the federally funded Mobile Irrigation Laboratory which operates in the UEC Planning Area. Agriculture is a major water user in the planning area. Changing on-farm irrigation scheduling and water management practices will play an increasingly important role in agricultural water conservation.

Irrigation management practices and technology interact, so that for example, a change in the type of irrigation system will generally require a change in irrigation scheduling to achieve the goal of water conservation while maintaining crop yield and economic return. An additional factor in agricultural water conservation is the energy savings possible through water conservation.

**Micro Irrigation Systems.** Micro irrigation systems achieve water savings by directly applying a high percentage of water to the root zone of the crop in controlled

amounts, so losses through deep percolation, drainage, etc. are reduced. In addition, application of water to areas not underlain by the root zone is limited. Installation of micro irrigation systems, or systems of equivalent efficiency, are required for new citrus and container nursery crops. Additional water savings can be achieved by promoting the installation of water-conserving irrigation systems on crops where it is not required (such as vegetables), and retrofitting irrigation systems for existing citrus and nursery crops.

Conversion of existing flood-irrigated citrus to micro-irrigation is another potential source of water savings (Table 23). It is estimated by IFAS that the initial cost to install a micro-irrigation system on citrus is $1,000 per acre and the system would have estimated annual maintenance costs of $25 per year (IFAS, 1993).

**Table 23.** Irrigation Costs and Water Use Savings Associated with Conversion from Seepage Irrigation to Low Volume.

| | |
|---|---|
| Initial cost ($/acre) | $1,000 |
| Operating cost ($/acre) | $25 |
| Water savings (inches/year) | 8.519 |
| Water savings (gallons per year) | 230,805 |
| Life (years) | 20 |
| Cost over life ($) | $1,500 |
| Water savings over life | 4,616,100 |
| Cost/1,000 gallons saved ($) | $0.33 |

The table summarizes the cost and potential water savings from one acre of conversion. The water savings from converting 25,000 acres of citrus from flood irrigation with a 50 percent efficiency to micro-irrigation with an 85 percent efficiency could result in a water savings of approximately 6 BGY (15.8 MGD). The analysis illustrates that given the large volumes of water used for irrigation by agriculture, water conservation savings (which can be achieved at a reasonable cost) will often be extremely cost effective compared to the costs of developing additional water supplies.